Sea cucumbers of the Comoros Archipelago

Yves Samyn[1], Didier VandenSpiegel[2] and Claude Massin[3]

Abstract

Sea cucumbers have been harvested for centuries in the Far East. Overexploitation, coupled with increasing demand has led to local depletion of certain standing stocks. *De novo* investigation at Grande Comore (one of the four main islands of the Comoros Archipelago) allows re-appraisal of local holothuroid biodiversity. Comparison with neighbouring areas allows extrapolation of holothuroid species richness to the rest of the archipelago. The current exploitation of holothuroids has been documented and there are definite signs of overexploitation. Conservation measures are urgently needed if exploitation of sea cucumbers in this area is to become sustainable in the near future.

Introduction

Holothuroids have been harvested for human consumption for centuries (Conand and Byrne 1993; Conand 2004). While harvesting was formerly concentrated in the Far East, market demand has shifted the exploitation grounds towards the western Indian Ocean during the last two decades (Marshall et al. 2001). Current exploitation has expanded to the point that sea cucumber populations in many parts of the Indo-Pacific are declining rapidly, with local extinctions being recorded (Samyn 2003; Thandar and Samyn 2004).

Very few scientific data are available concerning holothuroid biodiversity and the exploitation thereof for the four islands that constitute the Comoros Archipelago (including Grande Comore, Anjouan and Moheli, which constitute the Federal Islamic Republic of the Comoros, and Mayotte, which is an overseas "Comunauté Territoriale" of France). Cherbonnier (1988) has documented some isolated findings from Mayotte and Grande Comore; VandenSpiegel and Samyn (internal report) made a preliminary inventory of the sea cucumbers of Grande Comore; and Pouget (2003, 2004, 2005) did the same for Mayotte, although focussing more on commercial species. No information is currently available for Anjouan and Moheli.

The aim of the present paper is threefold: 1) recapitulate existing information regarding Comorian holothuroid biological diversity; 2) predict total Comorian holothuroid biodiversity by comparing the richness of the neighbouring areas (North Mozambique and the northwest of Madagascar) to that of the Comoros; and 3) document the current unbridled exploitation of these animals in the Comoros.

The present paper should aid local authorities as well as the general public in understanding the need to protect and sustainably manage this ecologically and economically important, but fragile, natural resource.

Inventory of holothuroid biodiversity in the Comoros Archipelago

Our current knowledge of sea cucumber biodiversity of the Comoros Archipelago is poor, as few studies have been devoted to these islands. Table 1 documents the 40 species currently known from the Comoros. Our *de novo* investigations have contributed significantly to this total, adding 19 new records. It is striking that the majority of the species (77.5%, or 31 out of 40) belong to the order Aspidochirotida, while the other two orders, Apodida and Dendrochirotida, are represented by 10% (4 out of 40) and 12.5% (5 out of 40 species), respectively.

In order to get a more complete sense of Comorian holothuroid species richness, we analysed any existing species that are common to both the east (northwest Madagascar) and west (north Mozambique) of the Comoros, but which have not yet been reported from the Comoros. This gap analysis revealed that 12 additional species are potentially present in the Comoros (Fig. 1). With these potential species included, the systematic composition is adjusted to: Aspidochirotida, ±69.25% (36 out of 52 species), Apodida, ±11.50% (6 out of 52 species) and Dendrochirotida, ±19.25% (10 out of 52 species). These proportions correspond relatively well to what has been reported for other tropical areas in the Indo-Pacific (Levin 1999; Massin 1999; Samyn 2003; Thandar and Samyn 2004), although apodids appear underestimated.

1. Royal Belgian Institute of Natural Sciences, Belgian Focal Point to the Global Taxonomy Initiative, B-1000 Brussels, Belgium
2. Royal Museum for Central Africa, Invertebrate Section, B-3080 Tervuren, Belgium
3. Royal Belgian Institute of Natural Sciences, Department for Malacology, B-1000 Brussels, Belgium

Table 1. **Shallow water holothuroids documented from the Comoros Archipelago. Pers. observ. means species was collected by our team in 2003 or 2004.**

Taxon	Reference	Taxon	Reference
APODIDA Brandt, 1835		*H. (Metriatyla) scabra* Jaeger, 1833	Pouget 2003, 2004, 2005
Chiridotidae Oestergren, 1898		*H. (Microthele) fuscogilva* Cherbonnier, 1980	pers. observ.
Polycheira fusca (Quoy & Gaimard, 1833)	Cherbonnier, 1988	*H. (M.) fuscopunctata* Jaeger, 1833	Pouget 2004; pers. observ.
Synaptidae Oestergren, 1898		*H. (M.) nobilis* (Selenka, 1867)	Pouget 2003, 2004, 2005; pers. observ.
Euapta godeffroyi (Semper, 1868)	pers. observ.	*H. (Platyperona) difficilis* Semper, 1868	pers. observ.
Synapta maculata (Chamisso & Eysenhardt, 1821)	pers. observ.	*H. (Selenkothuria) parva* Krauss in Lampert, 1885	Cherbonnier1988
Synaptula recta (Semper, 1868)	pers. observ.	*H. (Stauropora) pervicax* Selenka, 1867	Cherbonnier 1988
ASPIDOCHIROTIDA Grube, 1840		*H. (Theelothuria) maculosa* Pearson, 1913	pers. observ.
Holothuriidae Ludwig, 1894		*H. (Thymiosycia) impatiens* (Forskål, 1775)	Cherbonnier 1988
Actinopyga sp.	pers. observ.	*Pearsonothuria graeffei* (Semper, 1868)	Cherbonnier, 1988; pers. observ.
A. echinites (Jaeger, 1833)	Pouget 2004	**Stichopodidae Haeckel, 1896**	
A. mauritiana (Quoy & Gaimard, 1833)	Cherbonnier 1988; Pouget 2003, 2005; pers. observ.	*Stichopus chloronotus* Brandt, 1835	Cherbonnier 1988; Pouget 2003, 2004, 2005; pers. obs.
A. miliaris (Quoy & Gaimard, 1833)	pers. observ.	*S. hermanni* Semper, 1868	pers. observ.
A. obesa (Selenka, 1867)	Cherbonnier 1988; pers. observ.	*S. horrens* Selenka, 1867	pers. observ.
Bohadschia atra Massin et al., 1999	Cherbonnier 1988; Pouget 2005; pers. observ.	*Thelenota ananas* (Jaeger, 1833)	Pouget 2003, 2004, 2005; pers. observ.
B. cousteaui Cherbonnier, 1954	pers. observ.	*T. anax* H.L. Clark, 1921	pers. observ.
B. marmorata Jaeger, 1833	pers. observ.	**DENDROCHIROTIDA**	
B. subrubra (Quoy & Gaimard, 1833)	Pouget 2005; pers. observ.	**Cucumariidae Ludwig, 1894**	
B. vitiensis (Semper, 1868)	Pouget 2003, 2004, 2005	*Pentacta tesselara* Cherbonnier, 1970	pers. observ.
Holothuria (Halodeima) atra Jaeger, 1833	Pouget 2003, 2005; pers. observ.	*Havelockia turrispinea* Cherbonnier, 1988	Cherbonnier1988
H. (Lessonothuria) hawaiiensis Fisher, 1907	pers. observ.	**Phyllophoridae Oestergren, 1907**	
H. (L.) pardalis Selenka, 1867	Cherbonnier, 1988; pers. observ.	*Thyone comata* Cherbonnier, 1988	Cherbonnier1988
H. (L.) verrucosa Selenka, 1867	pers. observ.	**Sclerodactylidae Panning, 1949**	
H. (Mertensiothuria) hilla Lesson, 1830	pers. observ.	*Afrocucumis africana* (Semper, 1868)	pers. observ.
H. (M.) leucospilota (Brandt, 1835)	Cherbonnier1988; pers. observ.	*Ohshimella ehrenbergi* (Selenka, 1867)	pers. observ.

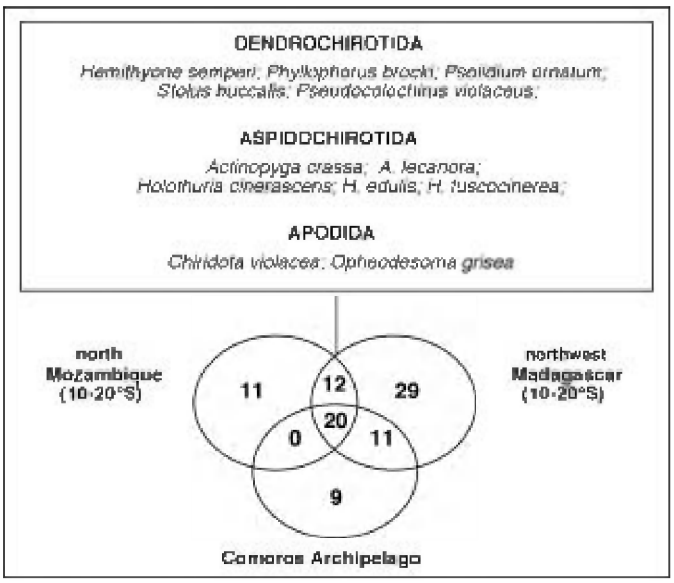

Figure 1. Gap analysis indicating potential Comoros Archipelago holothuriod species. Such gap analysis is appropriate given the fact that the northwest Madagascar Current connects the west coast of Madagascar with mainland Africa (Mozambique); the Comoros are situated between the latter areas, and the archipelago's fauna should resemble that of the areas to the west and east (see Thandar and Samyn 2004 for the oceanography of the region).

Exploitation of sea cucumbers in the Comoros Archipelago

1. Harvesting from the wild

The first national strategy and action plan for the conservation of biological diversity of the Federal Islamic Republic of the Comoros (2000, see http://www.biodiv.org/world/map.asp) contained an interesting account of the country's sea cucumber resources. This legal document concisely mentions the dangers associated with unbridled exploitation of sea cucumber stocks. More recently, VandenSpiegel and Samyn (internal report) expressed their concern that excessive exploitation of this fragile resource would inevitably lead to depletion. A recent survey by the latter authors, aided by one of us (CM) as well as a local NGO (AIDE, Association pour l'Intervention et le Développement de l'Environnement) and the responsible governmental ministry (DGE, Département Général de l'Environnement), came to the same conclusion.

As in the whole of the Indo-Pacific, the most sought-after species belong to Aspidochirotida. Target species include Holothuriidae [several *Actinopyga* spp., *Holothuria (Microthele) fuscogilva* Cherbonnier, 1980, *H. (M.) nobilis* (Selenka, 1867)] and Stichopodidae [*Stichopus chloronotus* Brandt, 1835, *Thelenota ananas* (Jaeger, 1833) and *T. anax* H.L. Clark, 1921] (Fig. 2).

We note that abundance of several of the above mentioned species appears to have decreased from November 2003 to October 2004, although at present this observation cannot be supported with hard data.

2. Processing into beche-de-mer

The process used to prepare species for the beche-de-mer trade is a simplified version of the process used throughout the Indo-Pacific (Conand 1990). Freshly collected specimens are gutted with a longitudinal incision, boiled for one hour, and dried in the sun. Contrary to other regions, the body wall of the specimens is not scraped to remove excessive ossicles. Burrowing of treated specimens in order to speed the process is also not carried out. Figures 4 and 5 illustrate the processing technique for some of the harvested species.

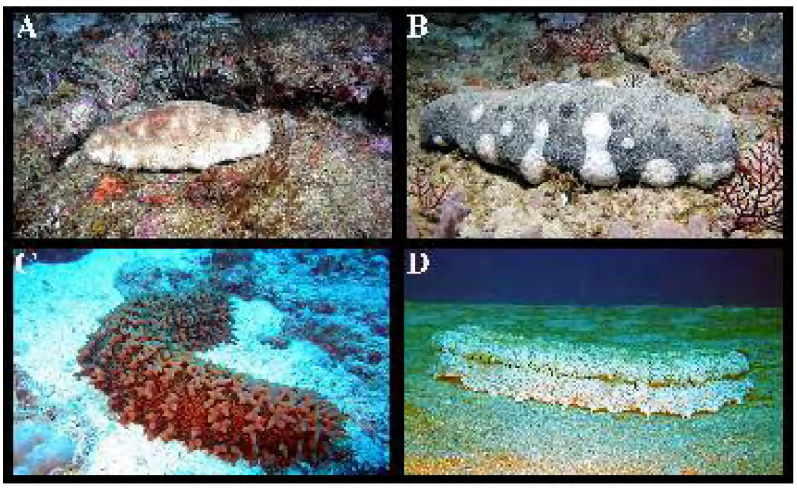

Figure 2. Commercial species belonging to the order Aspidochirotida. At Grande Comore, the main harvested species are: A) *Holothuria (Microthele) fuscogilva* Cherbonnier, 1980; B) *Holothuria (Microthele) nobilis* (Selenka, 1867); C) *Thelenota ananas* (Jaeger, 1833); and , D) *Thelenota anax* H.L. Clark, 1921.
Images: A by B. Van Bogaert; B by T. Schils; and C and D by D. VandenSpiegel

3. Farming as a sustainable approach

Chinese immigrants control the harvesting and processing of sea cucumbers in the Comoros. They have the expertise to process sea cucumbers into an exportable commercial product, and are aware of the significant retail value. Interviews with fishermen, Comorian environmental authorities and policy makers, in addition to personal observations, however, indicate that sea cucumbers are currently exploited in a detrimental manner. Various observations support this conclusion: 1) some high value commercial species such as *Holothuria scabra* were not found, even though some ideal habitats were encountered during our surveys; 2) seagrass beds at Grande Comore are nearly devoid of sea cucumbers; 3) densities of species appear to have dropped since our first survey in November 2003; 4) fishing is done at ever increasing depths (scuba divers now readily descend to 70 m or more); 5) some processed specimens are so small that they will fail to satisfy the retail market in the Far East; and 6) high as well as low value species are processed.

Fortunately, there is some positive news. Chinese fishermen, fully aware of their destructive fishing activities, have recently begun farming some of the high value species. We hope they will be successful in their initiative.

Figure 3. **Freshly gutted specimens of A) *Holothuria (Microthele) fuscogilva* Cherbonnier, 1980; B) *Thelenota anax* Clark, 1921; and C) an as yet undescribed color morph of *Holothuria (Microthele) nobilis* (Selenka, 1867).** All images by D. VandenSpiegel

Figure 4. **After gutting, specimens are boiled for one hour (A) and dried in the sun (B, C).** Image A & C by D. VandenSpiegel, B by A. Soifa

Figure 5. **Achieving durability in sea cucumber exploitation through farming initiatives. A) Tank for rearing sea cucumbers; B) *Holothuria (Microthele) nobilis* (Selenka, 1867); and C) *Thelenota ananas* (Jaeger, 1833).** All images by D. VandenSpiegel

Towards sustainable exploitation of Comoran sea cucumbers

In early 2003, the Government of the Federal Islamic Republic of the Comoros sought the assistance of Belgian specialists to train local scientists in sea cucumber identification and fishery management. Such education was indeed urgently needed, as exploitation by (predominantly) Chinese fishermen was pushing local stocks to extinction. Financially supported by the *Commission de l'Océan Indien* (COI) and the Belgian Development Cooperation (DGDC), we have responded by documenting the sea cucumber biodiversity of the Comoros through *de novo* sampling as well as by reviewing already existing museum collections. In addition, with the further support of the Belgian Development Cooperation, we trained two local scientists in the taxonomy and monitoring of sea cucumbers, equipped a laboratory with basic infrastructure and appropriate literature, and established a reference collection. These actions have allowed the establishment of a "Point focal holothuries" that is housed at the NGO AIDE in Moroni (Comoros).

Conclusion

The holothuroid fauna of the shallow Comoran waters was poorly known prior to our studies, which have expanded the number of known species of sea cucumbers from 22 to 40. Furthermore, gap analysis allowed the prediction of 12 additional species. Total shallow water holothuroid species richness thus seems to average around 50 species. Until all four islands of the Comoros have been adequately sampled, however, this figure should be viewed as an underestimate.

We take this opportunity to express our deepest concern in regard to the present, rather blind, overexploitation of sea cucumbers in the Comoros.

Acknowledgements

This investigation was carried out at the request of the "Département Général de l'Environnement", the responsible Ministry of the Federal Islamic Republic of the Comoros. This Ministry, through Mrs F. Abdalah, in joint cooperation with the NGO AIDE, through Mr A. Soifa and Mr A. Said, and the CNDRS, through Mr. M. Bachirou, proved indispensable in providing logistical support. Financial support was provided for sampling in the Comoros (2003) from the *Commission de l'Océan Indien* (project number COI/FED/03/025), and later (2004) from the Belgian Development Cooperation (through the specific framework project MRAC RAF72, as well as the Belgian Focal Point to the Global Taxonomy Initiative) and the Department of Invertebrates of the RBINS. This research would have been impossible without the kind help of "Itsandra Plongée", the Grande Comore-based dive club. Karin's and later Philippe's help proved indispensable for locating appropriate sampling sites. Finally, we wish to thank Danny for never failing to pick us up from the swell of the Indian Ocean.

References

Cherbonnier G. 1988. Echinodermes: Holothurides. Faune de Madagscar 70:1–292.

Conand C. 1990. The fishery resources of Pacific Island countries. Part 2. Holohturians. FAO Fisheries Technical Paper 272.2. Rome. 108 p.

Conand C. 2004. Present status of world sea cucumber resources and utilisation: an international overview. FAO Fisheries Technical Paper 463:13–23.

Conand C. and Byrne M. 1993. A review of recent developments in the world sea cucumber fisheries. Marine Fisheries Review 55:1–13.

Levin V.S. 1999. Feeding by shallow-water holothuroids (Echinodermata) and its effect on the environment. Lawrence J.M. (ed.). Polytechnica, Saint-Petersburg. 254 p.

Marshall N., Milledge S.A.H. and Afonso P.S. 2001. Stormy Seas for Marine Invertebrates – Trade in Sea Cucumbers, Seashells and Lobsters in Kenya, Tanzania and Mozambique. TRAFFIC East Southern Africa, Kenya. 70 p.

Massin C. 1999. Reef-dwelling Holothuroidea (Echinodermata) of the Spermonde Archipelago (South-West Sulawesi, Indonesia). Zoologische Verhandelingen 329:1–144.

Pouget A. 2003. Etude sur l'exploitation des holothuries à Mayotte et évaluation du stock exploitable sur le récif frangeant. Rapport de stage. Services de Pêches et de l'Environnement Marin de Mayotte (DAF), 39 p. + annexes.

Pouget A. 2004. Sea cucumber fisheries in the Mayotte reef system, Indian Ocean. SPC Beche-de-mer Information Bulletin 19:35–38.

Pouget A. 2005. Abundance and distribution of holothurians on the fringing reef flats of Grande Terre, Mayotte, Indian Ocean. SPC Beche-de-mer Information Bulletin 21:22–26.

Samyn Y. 2003. Shallow-water Holothuroidea (Echinodermata) from Kenya and Pemba Island (Tanzania). Studies in Afrotropical Zoology 292:1–158.

Thandar A.S. and Samyn Y. 2004. Shallow-water holothuroid (Echinodermata: Holothuroidea) biodiversity and biogeography of the subtropical east coast of South Africa. In: Heinzeller & Nebelsick (eds), Echinoderms: München, Taylor & Francis Group, London. 253–260.